Assessment of the Level of Digitalization of Russian Regions Under Conditions of Socio-economic Uncertainty

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Abstract The paper aims to identify the peculiarities of the digital development of Russian regions in terms of socio-economic uncertainty and determine the vector of regional policy to ensure accelerated digitalization of territories. The authors analyzed the main indicators of digital development households, organizations, and public authorities of Russian regions in the pre-pandemic period compared to the period of an active course of the pandemic, as well as at the stage of military and political instability. The research identifies Russian regions where digital development processes accelerated during the period of social and economic uncertainty caused by the COVID-19 pandemic, as well as regions where digitalization limitations became evident. The analysis allowed the authors to conclude about the multidirectional influence of socio-economic uncertainty on the course of digital development processes in Russian regions. On the one hand, the transformation in consumer behavior and the new external conditions of socio-economic uncertainty during the pandemic led to an accelerated digitalization of regional economic systems. On the other hand, the socio-economic uncertainty of 2020 has caused dramatic changes in the implemented business models, formats of organizations, and the nature of employment, which manifested itself in the reduction of most indicators of digital development of organizations in 2020. For each selected group of Russian regions,

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the authors proposed state policy measures in the field of digital development, which is supportive and accelerated in nature.

Keywords Region · Digitalization · Digital development · Socio-economic uncertainty · Pandemic · Political-military conflict · Accelerated digitalization · Public policy

JEL Classification O33 · R11 · R58

1 Introduction

Recently, the processes of social development have been accompanied by increasing uncertainty and turbulence. This applies to the regular emergence of economic crises (global and local) and, as a consequence, the aggravation of social tensions (deterioration of the quality of life, increasing social differentiation, dissatisfaction with the implemented policy, the development of an unfavorable situation in the labor market, etc.). The year 2020 and 2021 showed the vulnerability of global and national economies to epidemic threats. In a short period, the well-being of society was undermined, and existing problems of a socio-economic nature only intensified. The year 2022 became even tenser in terms of the unfolding of military and political conflicts, as well as a number of government decisions to impose sanctions on the Russian economy by a number of developed EU countries and the USA. This was another event contributing to increased uncertainty and turbulence in the world, regardless of the involvement of national economies in the immediate conflict [5, 8, 14, 19].

Under conditions of increasing uncertainty and turbulence, the objective processes in economic systems take on a somewhat different character. Particularly, digitalization processes, previously differentiated in terms of countries and regions of the world, have reached a new stage in their development, pushing people, businesses, and government agencies to improve digital infrastructure and increase the level of access to the use of ICTs [2, 11].

As for the digital development of Russian regions, it should be noted that the pandemic and military and political tensions were factors that pushed regional authorities to accelerate digitalization as a prerequisite for the sustainable development of regional economic systems, improving the level and quality of life of the population and inclusion in global communications processes.

2 Methodology

Features of digital development of countries and regions are described in the works of Bychkova et al. [2], Karpunin et al. [9–11], and Molchan et al. [15]. The authors emphasize the problems of providing access to the Internet to the population and

businesses, which hinder the penetration of digital technology in social processes. Another problem of the digital development of territories is the lack of motivation of enterprises in the regions to digitalize their own activities because of the need for additional investment in ICT. According to researchers, a significant factor in the low level of digital development of regions is the low digital literacy of citizens and the existing cyber risks, threatening users with loss of money, personal and professional information, and deteriorating reputation [12, 17].

This research aims to identify the peculiarities of the digital development of Russian regions in terms of socio-economic uncertainty and determine the vector of regional policy to ensure accelerated digitalization of territories. The research objectives are as follows:

1. To analyze the indicators of digital development of Russian regions in the pre-pandemic period and at the stage of active pandemic development;
2. To systematize the factors contributing to and hindering the intensification of digital development of Russian regions under conditions of socio-economic uncertainty;
3. To propose a set of regional policy measures to overcome the current limitations of digital development.

The most common approach to assessing the level of digitalization of the territory is the calculation of the Network Readiness Index of the Portulance Institute [4], which is based on indicators of the availability of digital technologies, their use by the population, businesses, and public administration, as well as indicators reflecting the level of institutional regulation of digitalization processes and the impact of digital technologies on various aspects of society (including quality of life, sustainable development of territories, etc.) [4]. Another approach to assessing the digitalization of regions is a comparative analysis of territories based on the calculation of integral indicators of digitalization. However, the operational data of regional statistics are not sufficient for this method [2]. To reflect the dynamics of ongoing changes in the level of digitalization of Russian regions, the authors conduct a comparative economic analysis of the digitalization indicators of the federal districts, followed by an explanation of the reasons for these trends and the corresponding grouping of regions.

3 Results

The basic condition for the digital development of the region is the digital infrastructure. In this aspect, the availability of devices and Internet access to the population and businesses is important. Let us analyze what has changed in the state of the digital infrastructure of Russian regions due to the increased socio-economic uncertainty caused by the COVID-19 pandemic.

The ability of households to have access to a computer and the availability of alternative access through televisions or cell phones differed significantly in different

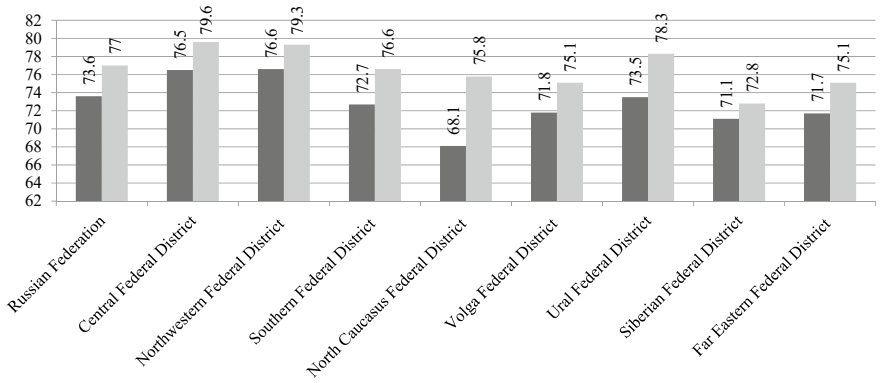

Fig. 1 Share of households with broadband Internet access, %, 2019–2020. *Source* Compiled by the authors based on [1]

regions of Russia before the COVID-19 pandemic. This is primarily caused by differences in income and education (the higher the level of education, the more likely people are to have access to ICTs) [16]. Other variables such as household size and type, age, gender, and location also play an important role (e.g., Internet access is greater in cities than in rural areas).

However, the pandemic contributed to the fact that to help citizens during the period of high alert deployed additional electronic services, regional authorities expanded existing services, negotiated with operators about the easing of communication services, and organized informational support, in some cases—direct financial and material.

The period of socio-economic uncertainty caused by the COVID-19 pandemic has benefited households' broadband connection dynamics (Fig. 1).

In Russia as a whole, the growth of this indicator amounted to 4.6%. The most significant increase in this indicator was achieved in the North Caucasus Federal district (+ 11.3% compared to 2019). Internet traffic increased in all regions of the district, as well as the time spent online. Simultaneously, the Internet coverage of socially important objects expanded in the region's cities and in the hard-to-reach mountainous regions. In the Chechen Republic, 60% of the region's residents were to have Internet access in 2020. Additionally, the quality of communication has also improved [20]. In 2021, the regions of the North Caucasus Federal district saw a significant increase in investment of telecommunications companies in infrastructure development, especially in tourist areas [13]. This expansion of the digital infrastructure has occurred because of the introduction of self-isolation regimes and the increasing need of the population to communicate, perform professional activities, and be included in learning processes.

In 2020, fixed Internet traffic growth was 34.2% over the same period in 2019. Despite a 51.9% year-over-year increase in mobile Internet traffic during the second quarter lockdown, overall mobile traffic growth for 2020 was 47%, below the trend of previous years. This confirms the assumption of the population's desire for reliable

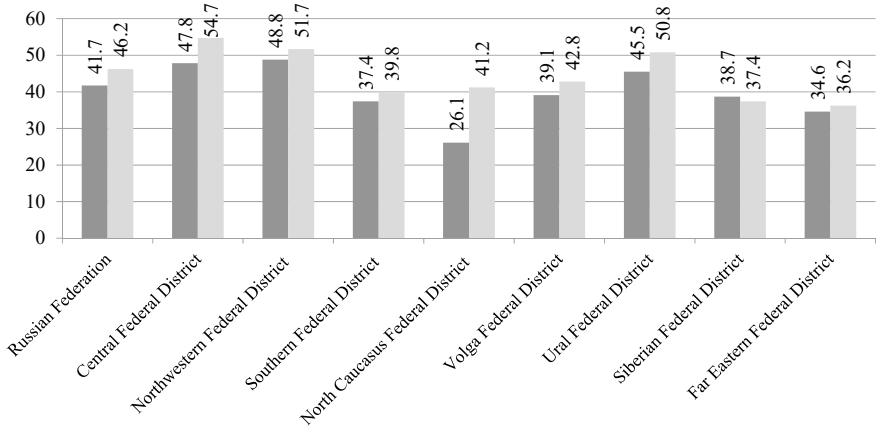

Fig. 2 Online purchase of goods and services by the population, % of the total population of the region, 2019–2020. *Source* Compiled by the authors based on [1, 6]

connectivity, which is provided by fast-developing fixed Wi-Fi, despite the changed working and living conditions during the pandemic [1].

Access to the Internet allows citizens to actively use digital platforms and services of digital services. This concerns the daily routine of citizens (paying utility bills, using online government services, purchasing goods), the realization of opportunities for online education, professional functions, and leisure activities. Naturally, the volume of goods and services purchased online increased during the pandemic due to the self-isolation of the population. In the pre-pandemic period, e-commerce services were most developed in the Northwestern Federal District (48.8% of households used them) and in the Central Federal District (47.8%). The most lagging region was the North Caucasian Federal District (26.1%). The situation changed in 2020 (Fig. 2).

In 2020, in all regions of Russia, except for the Siberian Federal District, there was an increase in the share of the population purchasing goods and services online. The new consumer habits of the population to use remote services to purchase goods and services have accelerated the development of online commerce. The greatest contribution to the development of the industry was made by online sales of convenience goods. The drop in purchasing power had an impact only on premium consumption. The maximum growth was achieved in the North Caucasian Federal District (57.9%); the decline was in the Siberian Federal District (− 3.4%) due to a decrease in consumer activity in the region due to mass layoffs.

In 2019, the level of broadband Internet access for organizations reached 93.1% in the Central Federal District, while the lowest value was in the North Caucasus Federal District (77.7%) [1, 6]. However, the pandemic had the opposite effect on the functioning of organizations. Due to the introduction of lockdowns across the country, there was a forced suspension of the production activities of most enterprises. Simultaneously, the management of enterprises transferred employees to remote work whenever possible. As a result, the indicators of connection of enterprises to

the Internet decreased: by 15.6% in Russia as a whole, with a maximum reduction of 21.1% in the Southern Federal District and by 17.5% in the Volga Federal District [6].

In the pandemic year of 2020, there was also a decrease in the number of organizations that used electronic data exchange systems with external information systems (− 18.9%), used SCM systems (− 34.8%), placed orders for goods and services on the Internet (− 6%), having special software to manage the procurement of goods (works, services) (− 39.2%), having special software to manage the sales of goods (works, services) (− 38.5%), using ERP-systems, in the total number of surveyed organizations (− 22.3%), and using CRM-systems (− 22.3%). However, in 2021, the dynamics for the above indicators of organizations' digital development began to straighten out and return to the previous vector [2, 7].

The COVID-19 pandemic has also impacted organizations' use of data protection tools transmitted over global networks. For example, in 2019, the share of organizations that used data protection tools in the total number of organizations in Russia surveyed was 89.5%. During the lockdown period of 2020, it decreased to 75.3%; in 2021, it showed an increase of 1.6% and amounted to 76.5%.

Another aspect of the digital development of the region's economy is the level of digitalization of the public administration system. This refers to the readiness of state and local governments to use ICTs in their activities, as well as in the process of providing public services. Thus, the indicators of the use of fixed (wired and wireless) Internet by public authorities in 2020 and 2021 increased significantly compared to previous periods and amounted to 86.9% and 87.8%, respectively. The number of special software tools for providing access to organizations' databases via global information networks and the use of Intranet in the activities of public authorities has also increased. The Russian e-government platform includes the following three components:

- The Unified Portal of State Services and Functions;
- The Unified System of Identification and Authentication;
- The System of Interagency Electronic Interaction.

In particular, the introduction of social distancing regimes has created restrictions for the population to personally apply for public services in specialized organizations in the region. The result of this situation was the close attention of regional authorities to maintain the smooth operation of these online services of state organizations in the regions and achieve growth in the overall share of services received by the population. The leading region for the distribution of online government services in the pre-pandemic period was the Central Federal District (83.2% of the population). Only 63.6% of the population used such services in the North Caucasus Federal District [3]. In 2020, the share of the population using online public services in Russia as a whole grew by 4.5% compared to 2019 [6]. These dynamics were observed in all regions of Russia except for the Volga Federal District (− 2% compared with 2019). Additionally, in Russia, the share of organizations that used the Internet to obtain certain types of public and municipal services increased by 1.2% and reached 67.7% in 2020.

Digitalization requires regular investment in ICT development. These costs are shared among regional populations, businesses, and regional governments. The public's interest in a seamless Internet experience during the pandemic has only grown stronger. Thanks to the pandemic, there is a public demand for change in the existing way of life and established socio-economic processes. The basis of these changes is the rapid and mass transition of the population to online communication and autonomous remote work. The changes taking place form an increased demand on the part of the population and businesses for communication services, development of data processing and storage infrastructure, growth of traffic consumption, and increase of network bandwidth, ensuring the stability of network connection and provision of a wide range of demanded digital services.

As a rule, large regions with a strong scientific and technological base have the largest volumes of investment in ICT development—these are the regions of the Central and Northwestern Federal Districts. However, the Volga Federal District and the Ural Federal District are closer to the leading regions in terms of "capital expenditures on information and computer equipment."

Socio-economic uncertainty caused by the pandemic has led to unstable dynamics of the total amount of regional spending on ICTs:

- In 2019, it was 161.4 billion rubles;
- In 2020, it was 225.1 billion rubles (+ 39.5% against 2019);
- In 2021, it decreased to 205.1 billion rubles (− 8.9% against 2020) [18].

Simultaneously, against a background of growing socio-economic uncertainty due to the events in Ukraine and the beginning of special operations of the Russian army, the regions began to increase these costs systemically. In 2022, their value reached 243.4 billion rubles (an increase of 18.7% against 2021).

In 2021, the leaders in actual expenditures on ICT (development of online services on public service portals, improvement of the digital health platform, support and development of IT infrastructure in terms of connecting socially important objects to the Internet, and providing digital transformation of cities) were the regions of the Central and Northwestern Federal Districts: Moscow (in 2021, the ICT spending was 76.3 billion rubles), St. Petersburg (21.6 billion rubles), and the Moscow Region (6.9 billion rubles).

Thus, the overall picture for the regions of Russia in the context of assessing changes in the level of digitalization in the context of socio-economic uncertainty is as follows (Table 1).

Thus, we can systematize the regions characterized by the acceleration of digitalization in a period of socio-economic uncertainty (Central, Northwestern, Southern, North Caucasus, Ural, and Far Eastern Federal Districts), as well as the regions that face the limitations of digitalization (the Volga and Siberian Federal Districts). The first group of regions requires the implementation of state policy in the field of digital development with an emphasis on the following supporting measures:

Table 1 Changes in the level of digitalization of the regions of Russia in the context of socio-economic uncertainty, 2019–2020

Region/indicator	Percentage of households with the broadband Internet access	Organizations' access to the broadband Internet	Online purchase of goods and services by the population	Use of public online services by the population	Investing in the development of ICT	Groups of regions
Central Federal District	⇧	⇩	⇧	⇧	⇧	1
North-Western Federal District	⇧	⇩	⇧	⇧	⇧	1
Southern Federal District	⇧	⇩	⇧	⇧	⇧	2
North Caucasus Federal District	⇧	⇩	⇧	⇧	⇧	1
Volga Federal District	⇧	⇩	⇧	⇩	⇧	2
Ural Federal District	⇧	⇩	⇧	⇧	⇧	1

(continued)

Table 1 (continued)

Region/indicator	Percentage of households with the broadband Internet access	Organizations' access to the broadband Internet	Online purchase of goods and services by the population	Use of public online services by the population	Investing in the development of ICT	Groups of regions
Siberian Federal District	⇧	⇩	⇩	⇧	⇧	2
Far Eastern Federal District	⇧	⇩	⇧	⇧	⇧	1

Source Compiled by the authors

- Improving the quality characteristics of digital infrastructure (e.g., increasing Internet bandwidth, improving the digital educational environment;
- Introducing inclusive solutions for municipal and regional services and services for people with disabilities);
- Implementing a set of measures in the field of cybersecurity;
- Improving digital literacy.

For problem regions, it is necessary to implement specialized measures, including the following:

- Development of the necessary information technology and telecommunications infrastructure for the organization of secure interagency electronic interaction;
- Modernization of the portals of electronic services; increasing the amount of funding for the implementation of ICT;
- Development of incentive mechanisms for the accelerated digitalization of businesses in the region.

4 Conclusions

The analysis allows us to conclude about the multidirectional influence of the socio-economic uncertainty caused by the pandemic on the course of digital development processes in Russian regions. On the one hand, the transformation of consumer behavior and the new external conditions of socio-economic uncertainty have led to an accelerated digitalization of regional economic systems in terms of expanding and improving the quality of digital infrastructure. On the other hand, the socio-economic uncertainty of the 2020 period caused fundamental changes in the implemented business models, the formats of organizations and the nature of employment. This manifested itself in the reduction of most indicators of digital development of organizations in 2020, primarily in the use of ICT in the activities of organizations. However, already in 2021, the dynamics of organizations' digital development indicators began to return to the pre-digital period, indicating their adaptation to the challenges of uncertainty. Russian regions where digital development processes accelerated during the period of socio-economic uncertainty were identified, as well as regions with existing digitalization constraints. State policy measures for supporting and accelerating digital development are proposed for Russian regions.

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